immediately. The attempts at "notching" are not effective in removing harmful interference emitted by the subject BPL systems.

Beyond this, I further note that **although access BPL is a Part 15 emitter and NOT a Shared Service, it should AT LEAST be mandated to follow Commission Rules in Shared Service situations where the Secondary emitter is not permitted to raise the interference level above 1 (one) dB. A recent NTIA report indicated that even a 1 dB increase in noise poses a slight risk of harmful interference. Clearly, a 14 dB increase will interfere with many signals that are routinely used in the Amateur Radio Service.** Clearly, as shown in my observations, the BPL signals are at least 14 dB above an average background level. That they might be 24 dB below some stated level suggests that the BPL system operator/manufacturer is short of the needed interference attenuation by at least 14 dB. Further, as the particular reference locations within these tests were not electrically "quiet" in a general sense, it follows that achieving a non-interfering status in a more quiet location would require more than the aggregate 38 dB of notch depth suggested by my test alone; indeed, as much as 45 dB or more will likely be required.

Should you or your staff wish to again visit the subject BPL trial areas, with reasonable notice, I will be happy to meet with you and escort you through these areas, while you operate my equipment and observe the harmful interference in the same manner that I have done.

Respectfully,

Thomas A. Brown
Amateur Radio Licensee N4TAB
5525 Old Still Rd.
Wake Forest, NC 27587

Attachments:
Representative List of Offending BPL Signals At Several Sites in South Wake County, NC
Text of my original complaint of April 27, 2004
Text of B. Franca letter of July 22, 2004

Representative List of Offending BPL Signals At Several Sites in South Wake County, NC

The measurements and observations listed in this document were made on August 29, 2004. Measurements were made using the apparatus as shown in Figure 1 of the related document to which this is attached.

NOTE THAT WHILE MANY FREQUENCIES WERE OBSERVED AS HAVING HARMFUL BPL INTERFERENCE, ONLY A FEW ARE LISTED HEREIN.

Holland Church Road - overhead BPL system. On frequency 21024 kHz, BPL carriers produced an offending and harmful interference at distances of more than 30 feet from the "injected" power line, with radiation peaks occurring periodically along the line and not just at the injector point. The level of attenuation required to reduce the offending BPL signal to the equivalent background noise level was 16 dB.

Feldmen Rd. - underground BPL system. Observations and measurements were made on Feldmen Rd., which is a part of the Holland Church Rd. system. At 1140 Feldmen Rd., within 50 feet of a ground mounted pedestal, harmful BPL signals were observed on 3869 kHz and required 16 dB of attenuation to reach the equivalent background noise level.

1505 Harvey Johnson Rd., one block North of 1140 Feldmen Rd., the 3869 kHz signal was heard at the same level as near the 1140 Feldmen Rd pedestal and also required 16 dB of attenuation to reduce the harmful interference to the equivalent background noise level.

Holland Church Rd. at the Donneymead intersection, there was sufficient BPL carrier on 3869 kHz to require 13 dB of attenuation to reduce to the equivalent background noise level. Note that this is several blocks removed from the emitter.

James Slaughter Rd. Overhead BPL system feeding underground systems at Woodchase and Whitehurst subdivisions. Near the entrance to the Woodchase subdivision, offending BPL carriers were observed at 24890 - 24990 kHz and 7296 kHz, both of which required 16 dB of attenuation to reduce to the equivalent background noise level.

Interestingly, I noted that the 12 meter (24890 - 24990 kHz) signals were propagated for more than 1 mile along Hwy 55 (W) at least to Dickens Rd. All along the route along Hwy 55 to Dickens Rd. and NE on Dickens Rd. to the intersection with James Slaughter Rd. the BPL interference was at a sufficient level to require 16 dB of attenuation to reduce the BPL signal to the equivalent background noise level.

Attachment: Copy of my formal complaint of April 22, 2004

To:
James Burtle, FCC
Alan Stillwell, FCC
Ann Wride, FCC
Riley Hollingsworth, FCC
Len Anthony, Progress Energy Corporation
Matt Oja, Progress Energy Corporation
Bill Godwin, Progress Energy Corporation
Chris Imlay, ARRL Counsel

Date: April 27, 2004

This complaint addresses the Progress Energy (Raleigh, NC) BPL trial areas situated along James Slaughter Road in southern Wake County, NC. This complaint should be considered in concert with previous complaints lodged with Progress Energy and The Federal Communications Commission regarding interference by devices operating under FCC Part 15 and which radiate harmful interference into the RF spectrum allocated to, and used by licensees of the Amateur Radio Service.

Notwithstanding previous efforts by Progress Energy and it's vendor, Amperion, Inc. to resolve outstanding complaints regarding interference to Amateur Radio spectrum, a recent correspondence from Mr. Len Anthony of Progress Energy states that his company's efforts had yielded results suitable to Progress Energy and that they would take no further action in this regard. This correspondence coldly and effectively terminates the good faith relationship that was engendered in October, 2003 with a view toward a cooperative effort that might yield a technical solution to an otherwise mutually adversarial situation.

In assessing the current technical aspects of the Progress Energy BPL trials, I believe that the interference described in this and previous complaints falls under Part 15 for the following reasons:

1) The Experimental license WD2XCA issued to Progress Energy (file number 0011-EX-PL-2003-granted February 10, 2003) allows operation of an experimental
radiator within a 20 mile radius of the coordinates N35:56:58, W78:34:23. None of the 3 trial sites in southern Wake County are within this radius.

2) Mr. Len Anthony's correspondence of April 20, 2004 specifically refers to FCC Rules, Part 15 as their model for compliance.

Therefore, my complaint is that Progress Energy's BPL trial site(s) emit radiated RF components that are harmful to the spectrum allocated to the Amateur Radio Service by the FCC and also provided under international treaty.

In preface to the specifics of my complaint, I would like to put into perspective, the use of an Amateur Radio HF mobile radio in the trial areas. As it is remarkably convenient that there are only a small number of Amateur Radio operators geographically situated near the trial areas to hear

the BPL signals from their homes, we have been,and are, using mobile HF equipment in the place of fixed installations in order to gauge the impact of interference in the respective geographical areas. Thus, an HF mobile radio, in the current context, is a "stand-in" for a fixed station at or near the same geographic location. It should be noted that, due to the generally poor efficiency and polarization of the HF mobile antennas, the results reported herein significantly *under-represent* the signal levels that would be encountered by fixed stations using horizontally polarized antennas, such as wire dipoles or directional arrays, operating in the same vicinity.

On Sunday, April 25, 2004, I drove my vehicle to the James Slaughter Road trial-site area. Upon arrival near the entrance to the Whitehurst residential subdivision, I began tuning through the allocated Amateur Radio bands and immediately observed significant interference to the 12 meter band, which extends from 24.890 mHz to 24.990 mHz. The interference was sufficient to mask, and did mask, useful signals that were clearly heard away from the BPL trial area. That the unique RF "signature" of the Progress Energy equipment completely blankets and renders useless an otherwise useful spectrum segment, clearly constitutes harmful interference.

This interference accrues into other portions of the allocated Amateur Radio HF spectrum, as well. Within the Whitehurst and Woodchase subdivisions (both adjacent to James Slaughter Road) BPL interference can be heard in the lower 25 kHz of the 10 meter band (28.000 mHz to 28.025 mHz).. In addition,
near the entrance to the Whitehurst subdivision, the entire 40 meter band (7.000 mHz to 7.300 mHz) is obscured by BPL interference. This interference does not radiate from the overhead wires alone; radiation also occurs from the pedestals where the underground wiring connects to customer distribution equipment.

Note that this interference is not confined to a single, narrow tone (carrier) as would be experienced from a typical Part 15 device such as an answering machine. This BPL interference signature consists of carriers spaced at approximately 1 kHz intervals through the entire 12 meter band, rendering normal communications operation impossible.

Where apparent attempts by Progress Energy to vacate the Amateur Radio spectrum have occurred in these systems, it has become obvious that the characteristics of any built-in "mitigation" filters do not exhibit "sharp" edges and that the "granularity", or precision with which any such filters can be defined and applied, is quite coarse. That is to say, that it seems that it is not possible to apply a "brick wall" filter topology, cleanly "notching" spectrum segments, rather, the filter "corner" must be set (possibly empirically) considerably away from the desired edge of the spectrum to be avoided. This observation suggests that the oft-touted claims of an "adaptive mitigation" process are overstated, at best.

Members of the local Amateur Community, including the undersigned, have waited patiently for several months while Progress Energy and it's vendor have attempted, in fits and starts, to remove the allocated Amateur Radio spectrum from that spectrum utilized by their installed BPL systems. The result, after these months of observation, is that

Progress Energy has not caused these systems to cease interference to the Amateur Radio spectrum.

There is a single conclusion that can be drawn from the history of this situation: interference from this type of system is a function of the design and cannot be mitigated, else it would have been accomplished by now. Further, it seems that this technology is quite immature and inherently lacking the technological merits so widely accorded it, owing to the lack of success following months of efforts toward effecting a solution.

FCC part 15 rules quoted below state that:

§ 15.5 General conditions of operation.

(a) Persons operating intentional or unintentional radiators shall not be deemed to have any vested or recognizable right to continued use of any given frequency by virtue of prior registration or certification of equipment, or, for power line carrier systems, on the basis of prior notification of use pursuant to § 90.63(g) of this chapter.

(b) Operation of an intentional, unintentional, or incidental radiator is subject to the conditions that no harmful interference is caused and that interference must be accepted that may be caused by the operation of an authorized radio station, by another intentional or unintentional radiator, by industrial, scientific and medical (ISM) equipment, or by an incidental radiator.

(c) The operator of a radio frequency device shall be required to cease operating the device upon notification by a Commission representative that the device is causing harmful interference. Operation shall not resume until the condition causing the harmful interference has been corrected.

Progress Energy is operating equipment under the terms of Part 15.5a, b and c above, and is subject to the restrictions therein.

I, therefore, respectfully demand that the Federal Communications Commission take the action specified under Part 15.5c and cause Progress Energy to cease operation of the Part 15 devices mentioned in this correspondence.

Respectfully,

Thomas A. Brown Amateur Radio licensee N4TAB
5525 Old Still Rd.
Wake Forest, NC
919-556-8477 (w)
919-528-3104 (h)
n4tab@earthlink.net

Attachments:

Previous complaints made to Progress Energy
Previous complaints made to the FCC
Copy of Mr. Len Anthony's email as referenced above

[Revision note: Paragraph 9 had two typographical errors that were subsequently mentioned in a follow-on errate email. Corrections were made in the foregoing paragraph 9 (only) and are underlined in both cases.}

Attachment: Copy text of letter received from Bruce Franca dated July 22, 2004

Thomas A. Brown, Amateur Radio Licensee N4TAB
5525 Old Still Rd.
Wake Forest, NC

Dear Mr. Brown:

This responds to your correspondence dated April 27, 2004, concerning a complaint with regard to harmful interference to Amateur Radio Service operations from Progress Energy Corporation's Broadband over Power Lines (BPL) trials in Southern Wake County, North Carolina. You state that on April 25, 2004, you drove your vehicle to the James Slaughter Road area and observed that the BPL trials being conducted by Progress Energy in that area "emit radiated RF components that are harmful to spectrum allocated the Amateur Radio Service." You state that the unique RF "signature" of the Progress Energy BPL equipment completely blankets, and therefore causes harmful interference to, several Amateur HF bands.

During the period June 28 and July 2, 2004, personnel from the FCC's Office of Engineering and Technology and Enforcement Bureau, including myself, traveled to North Carolina and undertook extensive testing and measurements of Progress Energy's BPL system deployed near Raleigh in the areas described in your complaint. We first conducted compliance testing of BPL overhead injectors on Slaughter Road and on Holland Church Road. In both instances, these devices were found to be in compliance with the FCC emission limits.

As part of these measurements, we examined the effectiveness of Progress Energy's steps to "notch" its BPL signals to avoid harmful interference. Section 2.1 of the Commission's rules defines harmful interference as "[i]nterference which ... seriously degrades, obstructs, or repeatedly interrupts a radiocommunication service," 47 C.F.R. § 2.1. The notch depth of the Holland Church Road injector was measured in two ways: 1) evaluating spectrum band averages using a bicon antenna and 2) evaluating OFDM peaks using a loop antenna. The results of these measurements indicated a notch depth of 23.4 to 25.0 dB below the Part 15 limits, with an average of 24 dB below. Given the relatively low levels of emissions permitted by BPL systems under the Part 15 rules and the distribution and propagation of the BPL signals of the Progress Energy system, notching at this level is sufficient to eliminate any signals that would be deemed capable of causing harmful interference, including interference to amateur operations. Measurements and observations with test equipment and a high quality amateur receiver show little field strength or observable signal levels in the notched bands. In no instances were signal levels found that would cause serious degradation, obstruction, or repeated interruption of the communications of amateur mobile stations or the fixed stations identified in your complaint. We did, however, find that the notching in the 10 meter band as implemented by Progress Energy allowed somewhat higher levels of signal in the lower 100 kHz at 28.0-28.1 MHz than the 24 dB notching reduction generally observed.

We next investigated emissions from the BPL system deployed in the vicinity of the Whitehurst subdivision, where the system is deployed using underground wiring. No BPL signals were detected in this area that would be deemed capable of causing harmful interference to mobile amateur operations.

Finally, we took measurements at two fixed amateur locations, 5813 Heathill Court and 509 Wyndham Drive, included in the complaint. No BPL interference was observed on any amateur frequencies at these two locations. In fact, no BPL signals were observed at these locations on any of the frequencies used for BPL operations by Progress Energy. A third site included in the complaint, at 201 Wilbon Road 301B, was not visited due to a GPS mapping error and subsequent time constraints.

Our conclusions from this investigation are that the Progress Energy BPL trial in the Raleigh area is in compliance with the Commission's rules and that the measures implemented to notch frequencies used by the Amateur Radio Service to avoid the potential for harmful interference are effective. We neither found nor observed any BPL signal levels or effects from the Progress Energy BPL operation that appeared to have the potential to seriously degrade, obstruct or repeatedly interrupt mobile amateur communications or fixed amateur communications at the specified addresses. In a separate action, we are however instructing that Progress Energy and Amperion, its equipment vendor, to slightly widen the notch at the lower edge of the 10 meter band by 100 kHz to ensure protection of amateur operations at 28.0-28.1 MHz.

Sincerely,

Bruce A. Franca
Deputy Chief,
Office of Engineering and Technology

cc: George Dillon, FCC/EB
Riley Hollingsworth, FCC/EB
Len Anthony, Progress Energy Corporation
Matt Oja, Progress Energy Corporation
Bill Godwin, Progress Energy Corporation
David Sumner, President, ARRL
Chris Imlay, Counsel, ARRL

James Burtle

From: Gary Pearce KN4AQ [kn4aq@arrl.net]
Sent: Tuesday, October 05, 2004 4:34 PM
To: Sheryl Wilkerson; Anh Wride; Alan Stillwell; James Burtle
Cc: Riley Hollingsworth; w1rfi@arrl.org
Subject: "Notching" BPL signals on Amateur Radio/SWL Bands

Greetings, FCC staff,

I have seen several references saying that there is a general feeling at the FCC that notching has been an effective tool for mitigation of BPL signal interference to Amateur Radio.

I have been closely involved in monitoring the recently concluded Progress Energy BPL trial near Raleigh, North Carolina, and I would like to briefly relate my observations that contradict that conclusion.

Progress Energy and their vendor, Amperion, used notching to reduce the BPL signal level on two of the overhead lines involved in their trial. One line had signals crossing the 12 meter band, and the other had signals crossing the 17 meter band.

The notches did indeed reduce the signal level. In his investigation, James Burtle reported that "Measurements and observations with test equipment and a high quality amateur receiver show little field strength or observable signal levels in the notched bands."

My experience was a little different. When I parked my mobile station across the street from the active power line, I could easily hear the BPL signals inside the notched bands. The signals were weak, but they were strong enough to cause harmful interference to other weak Amateur Radio signals, and were annoying to listen to while following the common Amateur Radio practice of tuning across our band looking for signals from other Amateur stations.

A few quick points to add:

- We keep pointing out that there were no Amateur Radio operators living inside the Progress Energy trial area. Our mobile observations were intended to be representative of the fixed stations that will be encountered in a general roll out of the system used in the trial (albeit with the reduced efficiency of mobile antennas).

Extrapolating from our mobile observation, in a general roll out the notched signals would cause harmful interference to fixed stations within a few blocks of the power line. This was demonstrated in practice by Jim Spencer in Cedar Rapids, Iowa, whose home was about 500 feet from the Amperion trial system in that city. After months of trying, Amperion was unable to reduce the signal at his home station below a clearly harmful level. Allient Energy cited the interference as one of the factors that caused them to end the trial early.

- In attempting to move and notch spectrum to mitigate interference, Amperion demonstrated only limited control of their hardware.

In their first change on the overhead line feeding the Holland Meadows subdivision south of Raleigh, they attempted to place a BPL signal across the spectrum that lies between the 20 and 15 meter Amateur bands, with a notch across the 17 meter band. They "missed the mark" at the low end of the spectrum block and ended up with a full-strength signal across the top 60 kHz of the 20 meter band (from 14.290 to 14.350 MHz).

Despite several complaints to Progress Energy and the FCC, this signal remained in place from May until August 2004. When it was finally moved, a few weeks before the system was shut down completely, Amperion's limited control caused them to push the BPL signals up the spectrum and cover the bottom 100 kHz of the 15 meter band with a full-strength signal (while they did clear the top 60 kHz of the 20 meter band).

Mr. Burtle's investigation inexplicably failed to document this signal, even though it was prominently mentioned in the complaint he was responding to (it was still in the 20 meter band when he observed the trial in late June, 2004).

- The Amperion BPL system does not contain itself to the intended spectrum blocks. Rather, signal "spills out" into adjacent spectrum. These overlapping signals are weaker than the main signal, and fade slowly as one tunes across the spectrum away from the edge of the main signal block. I can hear it well for 50 to 100 kHz from the edge of their main blocks, carrying the signals well into the adjacent Amateur Radio bands. The signal level is similar to the notched band signals. Again, the problem will be magnified for fixed stations near the lines. My much less efficient mobile can only demonstrate that the problem exists.

- Absolutely no consideration has been given to interference to international shortwave broadcast (SWBC) reception. I included several specific references to such interference in my complaints (one of which was copied in whole in the complaint filed by Tom Brown N4TAB, investigated by James Burtle - I've never received a reply to any of my own complaints). None of the SWBC bands are notched in any way, and weak to moderately strong SW signals are obliterated by the BPL signal when my vehicle is in the vicinity of the power line.

CONCLUSION
Can notching work to adequately mitigate interference to Amateur and Shortwave Broadcast radio? I would have to assume that eventually the BPL equipment manufacturers would be able to design hardware and software that can do the job. The equipment in place today does not.

Sincerely,

Gary Pearce KN4AQ
116 Waterfall Ct.
Cary, NC 27513
919-380-9944
kn4aq@arrl.net

Gary Pearce KN4AQ — editor, SERA Repeater Journal
Cary, NC — www.sera.org
919-380-9944 — kn4aq@sera.org
kn4aq@arrl.net
AOL/Yahoo Instant Messenger: KN4AQ
(send e-mail to be put on my "buddy list")

Alan Stillwell

From: James Burtle
Sent: Wednesday, March 31, 2004 8:10 AM
To: Alan Scrime; Alan Stillwell; Bruce Franca; Bruce Romano; Anh Wride
Subject: FW: Complaint of Gary Pearce

-----Original Message-----
From: Anthony, Len [mailto:len.anthony@pgnmail.com]
Sent: Wednesday, March 31, 2004 7:03 AM
To: James Burtle
Cc: Godwin, Bill; Oja, Matt
Subject: Complaint of Gary Pearce

Bill Godwin, a representative of Progress Energy, has contacted Mr. Pearce and arranged to meet with him and take joint measurements of the interference, or lack thereof, to ham radio transmissions allegedly caused by BPL at the Woodchase and Holland Meadows Subdivisions in Raleigh. Progress Energy believes that the first step in resolving Mr. Pearce's complaint is to reach a common understanding as to the actual measured impact on ham radio operation in these areas. PEC will update you once the measurements have been taken. Len Anthony

TEST REPORT

Certification # 1367-01

Laboratory ID
PRODUCT SAFETY ENGINEERING, INC.
12955 Bellamy Brothers Boulevard
Dade City, Florida 33525 USA
PH (352) 588-2209 FX (352) 588-2544

Submitter ID
Main.net Power Line Communications Inc.
12355 Sunrise Valley Dr.
Suite 150
Reston, VA 20190

Report Issue Date: 14 Aug 03
Sample S/N: PN PLS10010-000
Sample Receipt Date: 14 Jul 03

Sample Test Date: see data sheets

Test Report Number: 03F332
Model Designation: Nt Plus 3.0
Product Description: Carrier Current Modem (indoor)

Marketing Approval _____

Description of non-standard test method or test practice: ***None***

Estimated Measurement Uncertainty: ***Not Applicable***

Special limitations of use: ***None***

Traceability: ***reference standards of measurement have been calibrated by a competent body using standards traceable to the NIST.***

According to testing performed at Product Safety Engineering, Inc., the above-mentioned unit is in compliance with the electromagnetic compatibility requirements defined in regulations indicated on page (3) of the test report. The test results contained herein relate only to the model(s) identified above. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics.

As the responsible EMC Project Engineer, I hereby declare that the equipment tested as specified above conforms to the requirements indicated on page (3) of the test report.

Signature _____ Name David Foerstner

Title Engineering Group Leader Date 14 Aug 03

Reviewed by:
Approved Signatory _____ Date 14 Aug 03

DIRECTORY - EMISSIONS

		Page(s)
A) Documentation		
Test report		1 - 10
Directory		2
Test Regulations		3
General Remarks		10
Test-setups (Photos)		11 - 12
B) Test data		
Conducted emissions	10/150 kHz - 30 MHz	5, 9
Radiated emissions	10 kHz - 30 MHz	5, 9
Radiated emissions	30 MHz - 1000 MHz	6, 9
Interference power	30 MHz - 300 MHz	6, 9
Equivalent Radiated emissions	1 GHz - 18 GHz	7, 9
Antenna Disturbance Voltage	30 MHz - 1,000 MHz	7,9
C) Appendix A		
Test Equipment Calibration Information		A2
Test Data Sheets		A3 - A17__
D) Appendix B		
System Under Test Description		B2 - B4__

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544

EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to following regulations:

☒ - EN 50081-1 : 1992

☐ - EN 50081-2 : 1995

☒ - EN 55011 : 1998 / A1:1999 ☐ - Group 1 ☐ - Group 2

☐ - Class A ☐ - Class B

☐ - EN 55013 : 1990 / A12:1994 / A13:1996 / A14:1999

☐ - EN 55014 : 1993 /A1:1997 ☐ - Household appliances and similar

☐ - Portable tools

☐ - Semiconductor devices

☐ - EN 55022 : 1998 ☒ - Class A ☐ - Class B

☐ -AS/NZS 3548:1995 ☐ - Class A ☐ - Class B

☒ - ICES-003 ☐ - Class A ☐ - Class B

☐ - CNS 13438 ☐ - Class A ☐ - Class B

☐ - VCCI : 1999 ☐ - Class A ☐ - Class B

■ - FCC Part 15 ☐ - Class A ☐ - Class B

☐ - Certification
■ - Verification (Carrier Current Device Only)
☐ - Declaration of Conformity

☐ - FCC Part 18

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544

Environmental conditions during testing:

	LAB	OATS
Temperature: *	_____	: _____
Relative Humidity: **	_____	: _____

* The ambient temperature during the testing was within the range of (50° - 104° F) unless indicted above.
** The humidity levels during the testing was within the range of (10% - 90%) relative humidity unless indicated above.

Power supply system : 110 Volts 60 Hz SINGLE phase

Sign Explanations:

□ - not applicable
■ - applicable

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544

Emissions Test Conditions: CONDUCTED EMISSIONS (Interference Voltage)

The *CONDUCTED EMISSIONS (INTERFERENCE VOLTAGE)* measurements were performed at the following test location:

☐ - Test not applicable

☐ - Darby Test Site (Open Area Test Site)
■ - Darby Laboratory

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number
■ -	8028-50	Solar	50 Ω LISN	829012, 829022
☐ -	3825/2	Solar	50 Ω LISN	924840
■ -	EMC-30	Electro-Metrics	EMI Receiver	191
☐ -	8566B	Hewlett-Packard	Spectrum Analyzer	2421A00526
☐ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2043A00209
☐ -	85662A	Hewlett Packard	Analyzer Display	2403A07352
☐ -	8028-50	Solar	50 Ω LISN	903725, 903726
☐ -	FCC-TLISN-T4	Fisher Custom Com.	Telecom ISN	20072

Emissions Test Conditions: RADIATED EMISSIONS (Magnetic Field)

The *RADIATED EMISSIONS (MAGNETIC FIELD)* measurements were performed at the following test location:

☐ - Darby Test Site (Open Area Test Site)
■ - (3) Typical residential locations
☐ -

at a test distance of :

☐ - 3 meters
■ - 10 meters

☐ - Test not applicable

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number
☐ -	96005	Eaton	Log Periodic Antenna	1099
☐ -	BIA-25	Electro-Metrics	Biconical Antenna	4283
■ -	E7402A	Agilent	Spectrum Analyzer	US40240204
☐ -	85662A	Hewlett-Packard	Analyzer Display	2403A07352
☐ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2043A00209
■ -	ALR-30M	Electro-Metrics	Loop Antenna	824
☐ -	8447D	Hewlett Packard	Preamplifier	2944A06832
☐ -	EMC-30	Electro-Metrics	EMI Receiver	191
☐ -	ALA-130/A	Antenna Research	Loop Antenna	106

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544

The *RADIATED EMISSIONS (ELECTRIC FIELD)* measurements, in the frequency range of 30 MHz-500 MHz, were tested in a horizontal and vertical polarization at the following test location :

□ - Test not applicable

□ - Darby Site (Open Area Test Site)
□ - Darby Lab
■ - (3) Typical residential installations

at a test distance of :

■ - 3 meters
□ - 10 meters
□ - 30 meters

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number
■ -	96005	Eaton	Log Periodic Antenna	1099
■ -	BIA-25	Electro-Metrics	Biconical Antenna	4283
■ -	E7402A	Agilent	Spectrum Analyzer	US40240204
□ -	85662A	Hewlett-Packard	Analyzer Display	2403A07352
□ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2043A00209
□ -	8447D	Hewlett-Packard	Preamplifier (26dB)	2944A06832
□ -	EMC-30	Electro-Metrics	EMI Receiver	191
□ -	8568B	Hewlett Packard	Spectrum Analyzer	2407A03213
□ -	85650A	Hewlett Packard	Quasi-Peak Adapter	2043A00358
□ -	85662A	Hewlett Packard	Analyzer Display	2340A05806
□ -	LPA30	Electro-Metrics	Log Periodic	2280
□ -	BIA 30	Electro-Metrics	Biconical Antenna	3852

Emissions Test Conditions): INTERFERENCE POWER

The *INTERFERENCE POWER* measurements were performed by using the absorbing clamp on the mains and interface cables in the frequency range 30 MHz - 300 MHz at the following test location :

■ - Test not applicable

□ - Darby Lab
□ -

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number
□ -	MDS-21	Rhode&Schwarz	Absorbing Clamp	8608447020
□ -	8566B	Hewlett-Packard	Spectrum Analyzer	2421A00526
□ -	85662A	Hewlett-Packard	Analyzer Display	2403A07362
□ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2043A00209
□ -	8447D	Hewlett-Packard	Amplifier (26 dB)	2944A06832
□ -	EMC-30	Electro-Metrics	EMI Receiver	191

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544

The *EQUIVALENT RADIATED EMISSIONS* measurements in the frequency range GHz - GHz were performed in a horizontal and vertical polarization at the following test location :

□ - Darby Test Site (Open Area Test Site)
□ -
□ -
□ -

at a test distance of:

□ - 1 meters
□ - 3 meters
□ - 10 meters

■ - Test not applicable

Test equipment used :

	Model Number	Manufacturer	Description	Serial Number
□ -	8566B	Hewlett-Packard	Spectrum Analyzer	2421A00526
□ -	85662A	Hewlett-Packard	Analyzer Display	2403A07352
□ -	85650A	Hewlett-Packard	Quasi-Peak Adapter	2043A00209
□ -	8449B	Hewlett-Packard	Preamplifier	3008A00320
□ -	3115	Electro-Mechanics	Double Ridge Guide Horn	3810

The *ANTENNA TERMINAL DISTURBANCE VOLTAGE* in the frequency range 30 MHz - 1,000 MHz were performed.

□ - Darby Test Site (Open Area Test Site)
□ - Laboratory
□ -
□ -

■ - Test not applicable

	Model Number	Manufacturer	Description	Serial Number
□ -	2F9-3C4-3C5	Wavecom	UHF PAL TV Modulator	185879
□ -	2F1-3C4-3C5	Wavecom	VHF PAL TV Modulator	157728
□ -	A-8000	IFR	Spectrum Analyzer	1306
□ -	8648B	Hewlett-Packard	Signal Generator	3623A01433
□ -	8648B	Hewlett-Packard	Signal Generator	3623A01477
□ -	LMV-182A	Leader	RMS Milli-Voltmeter	8010091
□ -	3202	Krhon-Hite	Active filter	5899
□-	FMT115	Leaming	FM Modulator	NONE
□ -	371	UDT	Optical power meter	06657
□ -	TSG95	Tektronix	PAL video / Audio generator	B028883
□-				

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544

Equipment Under Test (EUT) Test Operation Mode - Emission tests :

The device under test was operated under the following conditions during emissions testing:

□ - Standby

□ - Test program (H - Pattern)

□ - Test program (color bar)

□ - Test program (customer specific)

■ - Practice operation

□ - Normal Operating Mode

□ -

Configuration of the device under test:

■ - See System Under Test Information in Appendix B

Rationale for EUT setup / configuration:

The EUT was placed in a constant transmit mode during the entire testing. Two of the homes chosen were served by underground electrical service and the third home was served by overhead electric service per the request of the FCC.

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2289 Fax (352) 588-2544

Emission Test Results:

Conducted emissions 10/150/450 kHz - 30 MHz				
The requirements are	■ - MET		□ - NOT MET	
Minimum limit margin	**15** dB	at	**1.69** MHz	
Remarks:				

Radiated emissions (magnetic field) 10 kHz - 30 MHz				
The requirements are	■ - MET		□ - NOT MET	
Minimum limit margin	**0.2** dB	at	**14.9** MHz	
Remarks:				

Radiated emissions (electric field) 30 MHz - 500 MHz				
The requirements are	■ - MET		□ - NOT MET	
Minimum limit margin	**>10** dB	at	MHz	
Remarks: No emissions were observed between (30 - 500) MHz which were a function of the transmitter.				

Interference Power at the mains and interface cables 30 MHz - 300 MHz				
The requirements are	□ - MET		☒ - NOT MET	
Minimum limit margin	dB	at	MHz	
Remarks:				

Radiated emissions GHz - GHz				
The requirements are	□ - MET		□ - NOT MET	
Minimum limit margin	dB	at	GHz	
Remarks:				

Antenna Terminal Disturbance Voltage 30 MHz - 1,000 MHz				
The requirements are	□ - MET		□ - NOT MET	
Minimum limit margin	dB	at	MHz	
Remarks:				

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544

GENERAL REMARKS:

The test equipment utilized during the radiated emissions testing consisted of a spectrum analyzer (EMC Analyzer) which was powered via a (12) volt "DC" marine deep cycle battery. The analyzer and battery were strapped to a handcart for ease in movement. The analyzer was connected to each antenna via a (50) foot coaxial cable. The analyzer was programmed to correct the raw readings to compensate for cable loss and antenna factors.

The FCC states the limits for the radiated emissions made at frequencies between (1.705 - 30) MHz at a (30) meter distance. We used (40) dB per decade as the extrapolation factor to adjust the limit from a (30) meter distance to a (10) meter distance as allowed in Part 15.31(f)(2). The limit for radiated emissions below (30) MHz, extrapolated to a (10) meter distance, is (48.6) dBuV/m.

The radiated data collected is reported while using each a peak, quasi-peak and average detector for information purposes only. The limit is compared to the quasi-peak data only. No emissions were observed between (1.705 -4) MHz.

We made measurements at each azimuth at each house in both horizontal and vertical polarites between (30 - 500) MHz. The only required measurements for conducted emissions are between (0.535 - 1.705) MHz and are included in the test report. ***NOTE: The power level was set to (5) during all of the testing.***

SUMMARY:

The requirements according to the technical regulations are

■ - met
□ - not met.

The device under test does

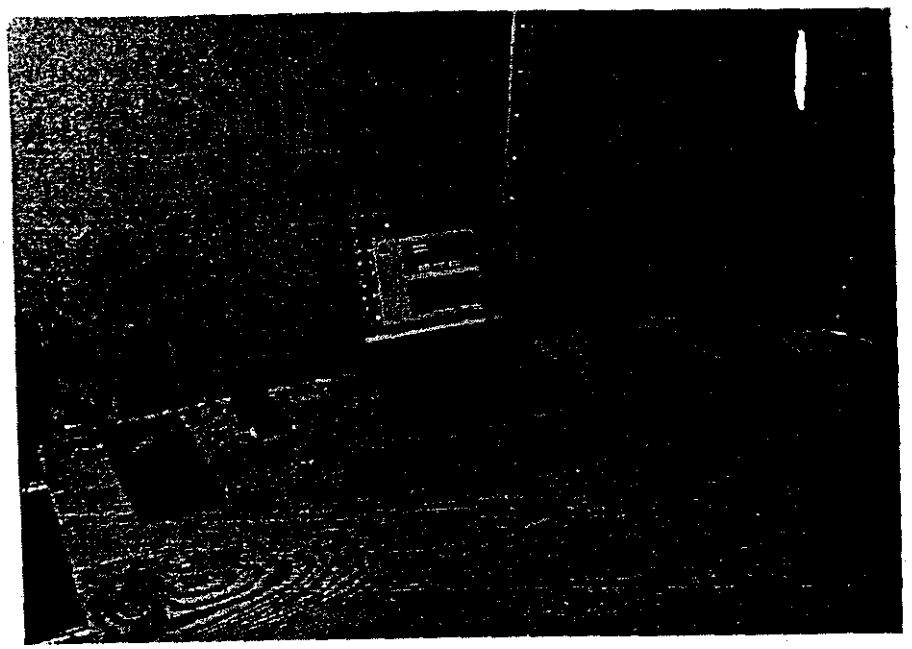
■ - fulfill the general approval requirements mentioned on page 3.
□ - not fulfill the general approval requirements mentioned on page 3.

Testing Start Date 07/14/2003

Testing End Date: 07/23/2003

- PRODUCT SAFETY ENGINEERING INC -

Test-setup photo(s):
Conducted emission 450/150 kHz - 30 MHz



Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544

Test-setup photo(s):
Radiated emission 30 MHz - 1000 MHz

SEE APPENDIX A

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544

APPENDIX

A

Test Equipment Calibration Information

&

Test Data Sheets

TEST EQUIPMENT CALIBRATION INFORMATION

Manufacturer	Model	Description	Serial Number	Cal Due
Hewlett Packard	8566B	Spectrum Analyzer	2421A00526	08/14/04
Hewlett Packard	85662A	Display	2403A07352	08/14/04
Hewlett Packard	85650A	Quasi-Peak Adapter	2043A00209	08/14/04
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	2944A06832	11/13/03
Hewlett Packard	8568B	Spectrum Analyzer	2407A03213	08/14/04
Hewlett Packard	85662A	Display	2340A05806	08/14/04
Hewlett Packard	85650A	Quasi-Peak Adapter	2043A00358	06/14/04
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	2944A06901	06/02/03
Hewlett Packard	8447D	Preamp 0.1 - 1,000 MHz	1937A03247	07/17/04
Hewlett Packard	8449B	Preamp 1 - 26.5 GHz	3008A00320	11/08/03
Hewlett Packard	8648B	Signal Generator	3443U00312	04/24/04
Hewlett Packard	8672A	Signal Generator	2211A02426	11/14/03
Eaton	96005	Log Periodic Antenna	1099	01/24/04
Electro-Metrics	LPA 30	Log Periodic Antenna	2280	12/06/03
Electro-Metrics	BIA 30	Biconical Antenna	3852	12/05/03
Electro-Metrics	BIA 25	Biconical Antenna	4283	01/22/04
Electro-Mechanics	3115	Double Ridge Guide Ant.	3810	11/07/03
Electro-Metrics	ALR30M	Magnetic Loop Antenna	824	12/12/03
Solar	8012	LISN	924840	12/29/03
Solar	8028	LISN	829012/809022	12/19/03
Solar	8028	LISN	903725/903726	11/18/03
Schwartzbeck	MDS-21	Absorbing Clamp	02581	09/13/03
Leader	LFG1310	Function Generator	8060233	04/24/04
IFR Systems	A-8000	Spectrum Analyzer	1306	11/13/03
Electro-Metrics	EMC-30	EMI Receiver	191	04/24/04
Antenna Research	ALA-130/A	Loop Antenna	106	03/14/04
Radio Shack	63-867	Temp/Hygrometer	N/A	04/18/04
Radio Shack	63-867A	Temp/Hygrometer	N/A	04/28/04

Product Safety Engineering, Inc 12955 Bellamy Brothers Blvd. Dade City, FL 33525
Tel (352) 588-2209 Fax (352) 588-2544